

## DESCRIPTION

## Speaker Attaching Construction and Speaker

## TECHNICAL FIELD

The present invention relates to a speaker attaching construction and speaker that a speaker is mounted on a plate by the utilization of an elastic deformation and restoration of an engaging piece.

## BACKGROUND ART

Conventionally, it is a general practice to use an attaching construction shown in Figs. 6 and 7 as a structure to mount a speaker on a plate. In Figs. 6 and 7, 1 is a speaker, 2 is a frame generally circumferential in form, and 3 is a cone-formed vibration plate having a resilient hook (edge) at nearly an upper end. The frame 2 has an upper plate 2a having an upper surface bonded, by abutment, with an underside of a top plate 3a of the vibration plate 3, thus fixing the vibration plate 3 on the frame 2 at the inner thereof. The frame 2 has a lower plate 2b having an underside arranged, by abutment, on the upper surface of a plate 4. A screw 5 at its thread 5a is screwed in a screw hole 2c formed in the lower plate 2b.

In the Fig. 6 attaching construction, a fixing hole 4a is formed by screwing in the plate 4 a thread 5a of a

screw 5, such as a tapping screw, being screwed in the screw hole 2c, thereby firmly fixing the frame 2 and the plate 4 together by screwing at three to four points. Meanwhile, in the Fig. 7 attaching construction, the screw 5 screwed in the screw hole 2c is screwed in the fixing hole 4b formed in a position corresponding to the screw hole 2c. A nut 6, e.g. a U-formed speed nut, is screwed from the tip of the thread 5a projecting downward of the fixing hole 4b, thereby tightening the frame 2 lower plate 2b and the plate 4 together at three to four points.

However, in the speaker attaching construction in Fig. 6 or 7, troublesome operation is required in tightening, one by one, the screw 5 by means of a screwdriver while holding the speaker 1 during attaching operation. Furthermore, the Fig. 7 attaching construction requires the operation to tighten the nut 6 at back of the plate 4 in addition to the operation to tighten the screw 5 at front of the plate 4.

Consequently, there is a proposal, in Patent Document 1 (JP-A-2001-352590), of an attaching construction that fixing is facilitated by the utilization of elastic deformation and restoration of an engaging piece. The attaching construction in Patent Document 1 is a speaker mounting structure that the frame is fixed to a plate by engaging in a fixing hole formed in the plate the

engaging hook and clip formed in the frame. By engaging, in the plate fixing hole, the engaging hook, downwardly bent in the left and right lower portion of the frame, the engaging clip at its slant guide is elastically deformed by abutted against the upper edge of the fixing hole. Elastically restored by passing of the slant guide through the fixing hole, the engaging clip at its U-formed engager engages with the upper edge of the fixing hole. Furthermore, the engaging hook and the engaging clip are arranged inner than the outer edge of an annular seal member bonded to the frame mounting surface and closely contacted with the plate, thereby blocking the water intruding at an opening or fixing hole of the plate by the seal member and preventing it from flowing toward the vehicular compartment.

Similarly, Patent document 2 (JP-B-7-9504) discloses a structure that a frame is projected with an insert-engager at one end and an insert-receiver at the other end thereof, so that an engaging fixture is inserted in the insert-receiver to hold it by a clamp piece and fit and fix a projection of the engaging fixture in a fit hole of the insert-receiver, whereby the frame insert-receiver is inserted in a plate insert hole and the engaging fixture is inserted in the insert hole into an engagement thereof with an edge of the insert hole, wherein the engager when

inserted in the insert hole is narrowed and the engager when passed is elastically restored.

Besides, Patent Document 3 (JP-A-4-34091) discloses an attaching construction eliminated of the need for tightening the nut at back of the plate. By using a cylindrical fixing tool having a polygonal engaging piece at one end and a screw hole at the other end and in a sheet form bendable circumferentially at between a screw hole and an engaging piece and having a plurality of clamp pieces generally L in form, the fixing tool is inserted in a insert-hole in the plate. By engaging the engaging piece with an engaging groove corresponding to the engaging piece form of the speaker main body, rotation is restricted. Further, a fixing bolt is screwed to the fixing tool, and projected circumferentially while bending a center region of the clamping piece thereby attaching the speaker main body to the plate.

#### DISCLOSURE OF THE INVENTION

In the meanwhile, in the attaching construction of Patent Document 1, 2 utilizing an elastic deformation and restoration of the engaging piece, the engaging hook or insert-engager provided at one side of the frame is caught in the fixing hole so that the frame is stably mounted on the plate by an elastic deformation and restoration of the

engaging piece serving as an engager of an engaging clip or fixture provided at the other side of the frame. After setting up the frame, the engager remains in a state elastically deformed to a certain extent. The stress, resulting from the elastic force, is applied to the frame at all times. This results in a fracture at a stress-concentrated point in the frame, thus constituting a cause to lower the durability. Furthermore, where the fixing hole is different in form or size in the plate or where the plate has a different thickness, the engager of the frame could not be engaged thus resulting in a disadvantage of inferior versatility.

The present invention, proposed in view of the problem, aims at providing a speaker attaching construction and speaker that fixing operation can be facilitated by the utilization of an elastic deformation and restoration of an engaging piece and, furthermore, stable setup of the speaker is available by eliminating the application of the stress due to an elastic force to the frame, thus improving durability in the frame or the fixing parts. Another object is to provide a speaker attaching structure and speaker excellent in versatility that can cope with the cases where the fixing hole is different in form or size or where the plate has a different thickness.

A speaker attaching construction in the invention is characterized by mounting, on a plate, a speaker removably provided with fixtures, having an engager on one side of an engaging plate and an engager formed with an engaging piece on other side of the engaging plate, at a plurality of points by engaging the engagers with receivers of a speaker frame, through clamping the plate and an adapter or the plate by means of the engaging pieces passed fixing hole of the plate and elastically restored and the engaging plate or the speaker frame.

Meanwhile, a speaker attaching construction in the invention is characterized by mounting, on a plate, a speaker removably provided with fixtures, having an engager on one side of an engaging plate and an engager formed with an engaging piece on other side of the engaging plate, at a plurality of points by engaging the engagers with receivers of a speaker frame, through engaging the engaging pieces passed fixing holes of the plate and elastically restored, at least one of the fixing points being arranged close to a lower end of the speaker frame, whereby a water intruding between the speaker frame and the plate is to be drained outward of the plate through an internal space of the fixture close to the lower end. The fixing point is taken, say, one or a plurality of points nearby the lower end immediately

beneath the center of a circular frame.

Meanwhile, a speaker in the invention is characterized by being removably provided with fixtures, having an engager on one side of an engaging plate and an engager formed with an engaging piece on other side of the engaging plate, at a plurality of points by engaging the engagers with receivers of a speaker frame, the engaging piece being deformed inward as inserted in a fixing hole of the plate and elastically restored after passed the fixing hole, to clamp the plate and an adapter or the plate by means of the elastically restored engaging piece and the engaging plate or the speaker frame. The fixture is suitably secured to speaker frame by tightening a screw in a screw hole formed in the engager.

In the speaker attaching construction and speaker of the invention, there are provided, on a speaker, fixtures having engaging pieces to elastically deform and restore. With the utilization of an elastic deformation and restoration of the engaging pieces, the speaker can be fixed by merely inserting the engaging pieces in fixing holes of the plate. Thus, the speaker can be easily fixed. For example, fixing operation is easy even in a narrow space, e.g. attaching a speaker to an automotive doorplate.

Furthermore, fixing is made by clamping the plate, etc. by the engaging pieces, engaging plates, etc. of

fixtures provided at a plurality of points, wherein fixing is made in the state the engaging pieces are elastically restored. This eliminates the application, to the frame, of a stress resulting from an elastic force. Thus, the speaker can be stably set up wherein durability is improved in the frame and fixing parts.

Meanwhile, by removably providing fixtures, e.g. by preparing a plurality of kinds of fixtures, handling is possible even in the case where the fixing hole is different in form or size. Furthermore, by suitably using fixtures that are different in the dimension of between the engaging plate and the engaging piece for example, it is easy to cope with a plate having a different thickness, thus providing excellent versatility.

Meanwhile, by arranging at least one of fixing points of fixtures in a position nearby the lower end of the speaker frame, the water intruding between the speaker frame and the plate can be drained outward of the plate through an internal space of the fixture nearby the lower end. This can enhance the effects of water-draining and waterproofing, e.g. prevent water from intruding in a vehicular compartment.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a state before



mounting a speaker in an embodiment to a plate. Fig. 2 is an explanatory perspective view showing a state fixtures and screws are disassembled in Fig. 1 to thereby engage the fixtures in fixing holes. Fig. 3 is a fragmentary vertical sectional view showing a fixing region with a fixture. Figs. 4(a), (b) are perspective and side views showing a fixture. Fig. 5 is an explanatory fragmentary vertical sectional view showing a fixing region with another fixture. Fig. 6 is a fragmentary vertical sectional view showing a fixing region in a first example of the conventional speaker attaching construction. Fig. 7 is a fragmentary vertical sectional view showing a fixing region in a second example of the conventional speaker attaching construction.

#### BEST MODE FOR CARRYING OUT THE INVENTION

Based on Figs. 1 to 4, explanation is made on an embodiment of a speaker attaching construction in the present invention.

A speaker 1 in this embodiment has a vibration plate 3, in a cone form having a resilient hook (edge) at generally an upper end thereof, fixed inner of a metal frame 2 in generally a circumferential form, as shown in Figs. 1 to 3. The frame 2 has an upper plate 2a having an upper surface bonded, by abutment, with a lower surface of

a top plate 3a of the vibration plate 3. Incidentally, although not shown, an adapter generally circumferential in form, such as a urethane cushion, is provided by adhesion on the upper surface of the top plate 3a of the vibration plate 3 provided on the upper plate 2a of the frame 2.

The frame 2 has a lower plate 2b provided with a thick-walled step 2d in an inner portion thereof. The step 2d is formed with an insert-hole 2e for a screw 5. In nearly a center of the insert-hole 2e, there is formed a first receiver 2f that is a hole square in cross-section wherein the square has a width/depth length greater than a diameter of the insert-hole 2e. In a lower end of the insertion-hole 2e, there is recessed a second receiver 2g that is square in form greater in width/depth length than the square of the first receiver 2f. Furthermore, a cutout is formed along an outer peripheral edge in the lower plate 2b of the frame 2 in a lower-surface outer portion thereof. In the cutout, a circumferential, waterproofing seal material 7 is arranged along the outer peripheral edge. Incidentally, the seal material 7 has a function as an anti-resonant plate for a plate 4. Meanwhile, because the insert-hole 2e and the receivers 2f, 2g are provided inner of the seal material 7 in the outer peripheral edge, water can be prevented from intruding to

the outer of the speaker through those points.

The lower plate 2b of the frame 2, at its underside, is arranged abutting against the upper surface of the plate 4. The frame 2 and the plate 4 are arranged such that the insert-hole 2e, first and second receivers 2f, 2g of the frame 2 corresponds in position to a fixing hole 4c of the plate 4. The first receiver 2f is formed in such a shape and size that an engager 8b of a fixture 8, referred to later, while the second receiver 2g is formed in such a shape and size that is to engage an engaging plate 8a of the fixture 8, referred to later.

Meanwhile, the fixture 8, formed of resin, such as ABS resin or nylon resin, has a rectangular-parallelepiped engager 8b in a position above the square engaging plate 8a, as shown in Figs. 3 and 4. Inside the engager 8b, there is vertically formed a screw hole 8c in which is to be screwed a thread 5a of the screw 5, e.g. a tapping screw. Below the engaging plate 8a, there is vertically formed a hollow 8e rectangular in cross-section at an inside of the engager 8d. In both sides of the engager 8d, square cutouts 8g are respectively formed extending from the engaging plate 8a to lower-end bridges 8f. Furthermore, in the upper ends of the both bridges 8f, there are respectively formed fan-like engaging pieces 8h in a manner spreading laterally in an upward direction.

The engaging piece 8h, arranged in the cutout 8g as viewed from side, has a slant 8i that is slanted in a manner spreading upwardly, a slant 8j that is slanted in a manner reducing upwardly, and a top end face 8k extending horizontally from a top end of the slant 8j.

The engager 8b of the fixture 8 is inserted and engaged in the first receiver 2f of the frame 2 while the engaging plate 8a of the fixture 8 is inserted and engaged in the second receiver 2g. The screw 5, to be inserted into the insert-hole 2e from the top surface of the step 2d, at its thread 5a, is screwed to the screw hole 8c of the fixture 8. By tightening the screw 5, the frame 2 and the fixture 8 are secured in the engagement state. Furthermore, the fixture 8 at its engager 8d is externally inserted in the fixing hole 4c of the plate 4. The plate 4 is fit between the underside of an engaging plate 8a peripheral protrusion and the upper end face 8k of the engaging piece 8h. The fixture 8 is engaged with and fixed on the plate 4.

The speaker 1 is rendered in a state that the fixture 8 is previously integrated with the frame 2 by screwing with a screw 5, as shown in Fig. 1. When fixing the speaker 1 to the plate 4, fixtures 8 are arranged in positions of fixing holes 4c in the plate 4. While the speaker 1 at its lower portion is inserted in the mount

hole 4d of the plate 4, the engagers 8d at their tips are inserted in the fixing holes 4c. The fixing hole 4c is circular, to have a diameter formed nearly equal to or somewhat smaller than the outer diameter of a circular region of the engager 8d. As the insertion proceeds, the wing-like engaging piece 8h at its slant 8i goes into abutment against an outer edge of the fixing hole 4c. By the outer edge of the fixing hole 4c, the outward protrusion of the engaging piece 8h is pushed in the hollow 8e and hence the engaging piece 8h is deformed elastically.

Thereafter, when the slant 8i at its outer end passes the fixing hole 4c, the engaging piece 8h goes into elastic restoration. By the elastic force of the engaging piece 8h, the engaging piece 8h passes the inner side of the fixing hole 4c while putting the slant 8j along the outer edge of the fixing hole 4c. When completely passed at the inner, the engaging piece 8h is elastically restored completely. Simultaneously, the plate 4 is fixedly clamped between the upper end face 8k of the engaging piece 8h and the underside of the engaging plate 8a. Thus, the fixtures 8 and the speaker 1 fixed with the fixtures 8 are engaged and stably fixed on the plate 4.

The dimension, between the upper end face 8k of the engaging piece 8h and the underside of the engaging plate

8a, is provided, say, correspondingly to a thickness of the plate 4. The plate 4 even different in thickness can be easily coped with by using fixtures 8 that the dimension of between the upper end face 8k of the engaging piece 8h and the underside of the engaging plate 8a corresponds to the thickness of the plate 4. Meanwhile, in the state the speaker 1 is attached, the engaging pieces 8h are elastically restored by the fixtures 8 provided in a plurality of points. The frame 2 and the fixtures 8 are free from the stresses imposed by an elastic force.

Thereafter, in the case of removing the speaker 1 out of the plate 4, the screws 5 are loosened and removed to withdraw the frame 2 out of the inserted fixtures 8 thus removing the speaker 1. The fixtures 8 in a state left on the plate 4 can be removed by inserting the hand through the mount hole 4d and pushing toward the front while pushing the engaging pieces 8h at the both sides into the hollow 8e. Accordingly, removal operation is easy to perform. By inserting the removed fixtures 8 again in the frame 2, the speaker 1 can be easily fixed again on the plate 4.

Next, explanation is made on a speaker attaching construction in another embodiment, based on Fig. 5. Incidentally, the structure not especially referred to in

this embodiment is basically similar to the speaker 1 in the embodiment and the construction of attaching the same.

In the speaker 1 of this embodiment, there is internally provided a cone-formed vibration plate 3, not shown, in a generally circumferential frame 2 wherein, in an insert-hole 2e in a step 2d of a frame 2, there is formed a first receiver 2f that is a hole square in cross-section having a square width/depth length greater than a diameter of the insert-hole 2e. Furthermore, on the underside of a lower plate 2b of the frame 2, there is secured a fixed plate 2h in a plate-circumferential form. In a corresponding point of the fixed plate 2h to the insert-hole 2e, there is formed a square hole greater in length than the square of the first receiver 2f. The hole is provided as a second receiver 2g. Along the periphery of and on the outer surface of the fixed plate 2h, there is firmly fixed an adapter 9 in a plate-circumferential form, e.g. urethane sponge cushion having a waterproofing and vibration-preventing function.

Meanwhile, the fixture in this embodiment is formed longer in the distance between the underside or outer surface of the engaging plate 8a and the upper end face 8k of the engaging piece 8h, than the fixture 8. The engaging plate 8a is inserted in and engaged with the second receiver 2g of the fixed plate 2h while the engager

8b is inserted in and engaged with the first receiver 2f of the frame 2. The screw 5, to be inserted in the insert-hole 2e, at its thread 5a is screwed to the screw hole 8c of the fixture 8. By tightening the screws 5, the frame 2 and the fixtures 8 are firmly fixed in the engagement state.

The attaching construction in Fig. 5 provides a correspondence between the second receiver 2g, first receiver 2f and insert-hole 2e of the fixed plate 2h and the mount hole 40a of the vehicular door panel 40. By abutting the outer surface of the adapter 9 against the door panel 40, the frame 2 is arranged. By inserting the engager 8d of the fixture 8 in the mount hole 40a of the door panel 40 in a direction of from the inner to outer, the fixture 8 is engaged in the door panel 40 due to an elastic deformation and restoration of the engaging piece 8h similarly to the foregoing embodiment, thereby arranging the speaker 1 facing the inward of the door panel 40. In this embodiment, there is formed a space between the outer surface of the fixed plate 2h and the door panel 40 in the attaching state, providing a circumference hermetically closed by the interposing adapter 9.

Furthermore, of among the three fixing points (see Figs. 1 and 2) in the frame 2 and door panel 40 due to the



fixtures 8, the fixing point with the Fig. 5 fixture 8 is provided in a position close to the lowermost end lying immediately below a circular center, in front view, of the speaker 1. With the structure, the water at around the speaker 1 or the water on the speaker 1 can be drained to the outside of the door panel 40 through the fixture 8 hollow 8e or the like, as shown by the two-dot-chain line in the figure. Thus, it is possible to prevent or suppress the gathering of an adapter 9 water lying in a position between the door panel 40 and the fixing plate 2h at an outer of the fixture 8. With the excellent draining function of the fixture 8 and the waterproofing function of the adapter 9, water is prevented from intruding in a vehicle compartment thus providing a high waterproofing effect.

#### INDUSTRIAL APPLICABILITY

The speaker attaching construction and speaker of the invention is suitable if used, say, where a speaker is fixed on a speaker-mounting plate to be provided in an automobile. Besides, it can be used where a speaker is fixed on a plate to be provided in a proper location.